

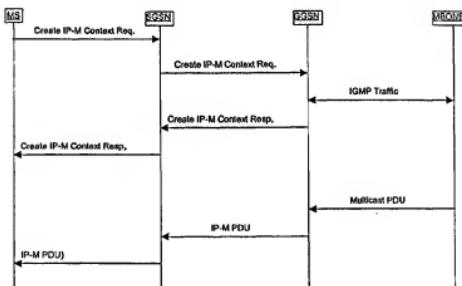


## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>7</sup> :	A1	(11) International Publication Number: WO 05/57601
H04L 12/18, 12/56, 29/06		(43) International Publication Date: 28 September 2000 (28.09.00)

(21) International Application Number:	PCT/EP99/01969	(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
(22) International Filing Date:	19 March 1999 (19.03.99)	
(71) Applicant (for all designated States except US):	NOKIA NETWORKS OY [FI/FI]; P.O. Box 300, FIN-00045 Nokia Group (FI).	
(72) Inventors; and		
(75) Inventors/Applicants (for US only):	MUHONEN, Ahti [FI/FI]; Hääläidenkatu 5 B 37, FIN-00210 Helsinki (FI); ROOKE, Michael [GB/IT]; Nokia Telecommunications Oy, P.O. Box 321, FIN-00045 Nokia Group (FI).	
(74) Agents:	PELLMANN, Hans-Bernd et al.; Tiedtke-Bühling-Kinne et al., Bavariaring 4, D-80336 München (DE).	Published With international search report.

(54) Title: METHOD AND NETWORK ELEMENT FOR FORWARDING MULTICAST MESSAGES



## (57) Abstract

The present invention relates to a method and network element for forwarding a multicast message received from an external packet data network (PDN) to subscribers (MS) of a packet radio network, wherein a subscriber-specific information defining multicast messages to be received by the subscribers is stored in a network element (GGSN) of the packet radio network. Based on this subscriber-specific information, a point to point connection is established between the multicast content provider of the multicast message and a subscriber having joined the corresponding multicast group. The subscriber may request a list of available multicast groups from the network element and may inform the network element of the multicast messages he wants to listen to by using a point to point context activation. Thus, the network element which may be a gateway GPRS support node plays an arbitrator role for multicast messages. Thereby, only minor changes of standard network elements are required.

*FOR THE PURPOSES OF INFORMATION ONLY*

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav	TM	Turkmenistan
BF	Burkina Faso	GR	Greece	ML	Republic of Macedonia	TR	Turkey
BG	Bulgaria	HU	Hungary	MN	Mali	TT	Trinidad and Tobago
RJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's	NZ	New Zealand		
CM	Cameroon	KR	Republic of Korea	PL	Poland		
CN	China	KZ	Kazakhstan	PT	Portugal		
CU	Cuba	KZ	Kazakhstan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

**METHOD AND NETWORK ELEMENT FOR FORWARDING MULTICAST MESSAGES**

5

FIELD OF THE INVENTION

The present invention relates to a method and network element for forwarding a multicast message received from an  
10 external packet data network, such as the Internet, to subscribers of a packet radio network, such as the General Packet Radio Service (GPRS) network.

15

BACKGROUND OF THE INVENTION

The GPRS is a new GSM (Global System for Mobile Communication) service that provides actual packet radio access for mobile GSM users. The main benefit of GPRS is  
20 that it reserves radio resources only when there is something to send. The same radio resource is shared by all mobile subscribers in a cell, providing effective use of the scarce resources. The need for packet radio is based on the high burstiness of data applications. GPRS facilitates  
25 a variety of applications, such as telemetry, train control systems, interactive data access, toll road charging systems, and Internet browsing using the World Wide Web.

When compared with the current circuit switched GSM  
30 network, the operation of GPRS is very different. The main objective of GPRS is to offer a connection to standard data networks using protocols such as TCP/IP (Transmission Control Protocol/Internet Protocol), X.25, and CLNP (Connection Less Network Protocol).

- 2 -

In order to access the GPRS services, a mobile station (MS) first makes its presence known to a network by performing a GPRS attach. This operation establishes a logical link between the MS and a serving GPRS support node (SGSN), and 5 makes the MS available for messages over GPRS, paging via SGSN, and notification of incoming GPRS data.

In order to transmit and receive GPRS data, the MS activates a desired packet data address. This operation 10 makes the MS known in a corresponding gateway GPRS support node (GGSN), and interworking with external data networks can commence. User data is transferred transparently between the MS and the external data network with a method known as encapsulation and tunneling, wherein data packets 15 are equipped with a GPRS-specific protocol information and transferred between the MS and the GGSN. This transparent transfer method lessens the requirement for a GPRS PLMN (Public Land Mobile Network) to interpret external data protocols, and it enables easy introduction of additional 20 interworking protocols in the future. User data can be compressed and protected with retransmission protocols for efficiency and reliability.

The GPRS supports interworking with networks based on the 25 Internet protocol (IP). The GSM PLMN GPRS service is an IP domain, and services offered to mobile terminals by a GSM service provider are globally addressable through the network operators addressing scheme.

30 However it has not yet been defined how an MS joins and leaves group calls received from an external packet data network (PDN), e.g. an IP/M group call received from the Internet, and how the GPRS network creates a connection between a multicast content provider and the MS.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to

5 provide a method and network element for forwarding a multicast message, by means of which a mobile subscriber may join and leave a group call of an external packet data network.

10 This object is achieved by a method for forwarding a multicast message received from an external packet data network to subscribers of a packet radio network, comprising the steps of:

storing a subscriber-specific information, which defines

15 multicast messages to be received by said subscribers, in a network element of the packet radio network;

establishing a point to point connection between a multicast content provider and a subscriber, when said subscriber-specific information indicates that the received

20 multicast message is to be received by the subscriber; and transmitting the multicast message from the multicast content provider to the subscriber via the established point to point connection.

25 Additionally, the above object is achieved by a network element for forwarding a multicast message received from an external packet data network to a subscriber of a packet radio network, comprising:

receiving means for receiving the multicast message from

30 the external packet data network;

storing means for storing a subscriber-specific information which defines multicast messages to be received by the subscriber;

control means for establishing a point to point connection

35 between a multicast content provider of a received

- 4 -

multicast message and a subscriber, when the subscriber-specific information indicates that the received multicast message is to be received by the subscriber; and  
transmitting means for transmitting the received multicast  
5 message to the subscriber via the established point to point connection.

Accordingly, a multicast service such as the IP-M service, of an external packet data network can be implemented in  
10 the packet radio network, i.e. the GPRS. Thus, the network element, for example, the GGSN, plays an IP-M arbitrator role and acts as a distribution node in which subscriber-specific lists of multicast groups, for example IP-M groups, to which specific subscribers want to listen are  
15 stored. The multicast messages may then be forwarded to a respective subscriber using a usual point to point connection.

Hence, only minor changes of the respective network element  
20 in the packet radio network are required.

Preferably, a request for available groups for multicast messages may be transmitted from a subscriber to the network element, wherein an information defining the  
25 desired groups which the subscriber wishes to join is returned from the subscriber to the network element. The subscriber request may be transmitted with an IP-M context request.

30 Preferably, the subscriber-specific information is a list which maps group identities of multicast groups to connection identifications of subscribers belonging to the multicast groups. In particular, the group identity may be an IP-M group ID and the connection identification may be a  
35 GPRS tunnel ID.

- 5 -

The transmitting means of the network element may be arranged to transmit an information defining available multicast groups to subscribers which have indicated their  
5 interest in multicast messages. The multicast group information may be transmitted with an IP-M context procedure.

BRIEF DESCRIPTION OF THE DRAWINGS

10

In the following, the present invention will be described in greater detail on the basis of a preferred embodiment with reference to the accompanying drawings, in which:

15 Fig. 1 shows a general block diagram of GPRS network to which an external packet data network is connected,

Fig. 2 shows a general block diagram of a gateway GPRS support node according to the preferred embodiment of the  
20 present invention, and

Fig. 3 shows a transmission diagram of a context activation with a multicast packet transfer according to the preferred embodiment of the present invention.

25

DESCRIPTION OF THE PREFERRED EMBODIMENT

In the following the preferred embodiment of the method and  
30 network element according to the present invention will be described on the basis of a GPRS network shown in Fig. 1.

According to Fig. 1, the GPRS provides a bearer service from the boundary of a packet data network (PDN) to a GPRS  
35 MS. The serving GPRS support node (SGSN), which is at the

- 6 -

same hierarchical level as a mobile switching center, keeps track of the individual MSs' location and performs security functions and access control. The SGSN is connected to a base station system (BSS) which provides a radio connection 5 to the MS. The GGSN provides interworking with the external PDN and is connected with SGSNs via an IP-based GPRS backbone network.

According to the preferred embodiment of the present 10 invention, a subscriber-specific information such as a list is stored in the GGSN, which defines multicast groups joined by specific MSs. Thus, upon receiving an IP-M group call from the PDN, the GGSN may check the subscriber-specific information as to whether an MS of the GPRS 15 network has joined the corresponding IP-M group, and establishes a point to point connection between the multicast content provider and a respective MS, in case the subscriber-specific information indicates that the respective subscriber has joined the corresponding 20 multicast group.

In Fig. 2, a general block diagram of the GGSN is shown, comprising only those features essential to the present invention. According to Fig. 2, the GGSN comprises a 25 receiver Rx 11 connected to the external PDN in order to receive data traffic, such as an IGMP (Internet Group Management Protocol) traffic. Furthermore, the receiver Rx 11 is connected to the SGSN in order to receive messages from the SGSN.

30 Furthermore, the GGSN comprises a transmitter Tx 13 arranged to transmit data traffic and messages to the SGSN. The required establishment of connections and control of transmitting and receiving operations is performed by a 35 control unit 10 to which a context memory 12 is connected.

- 7 -

The context memory 12 is used to store a context information which is required by the control unit 10 in order to establish connections between subscribers such as the MS and the external PDN.

5

According to the preferred embodiment of the present invention, a GPRS point to point like context activation is used for forwarding an IP-M group call received from the external PDN. In the following, such an IP-M to IGMP

10 context activation is described with reference to Fig. 3.

According to Fig. 3, the MS informs the SGSN by a Create IP-M Context Request message of the IP-M group call it wants to join. Then, the SGSN establishes an IP-M context  
15 and derives a GGSN address. Based on this address, the SGSN creates a tunnel identification (TID) for the requested IP-M context by combining the IMSI (International Mobile Station Identity) stored in the MM (Mobility Management) context with the NSAPI (Network Layer Service Access Point Identifier) received from the MS. Thus, the TID includes the IMSI and the NSAPI and is used to create a point to point (PTP) connection between the MS and the GGSN.  
20 Subsequently, the GGSN is informed by a Create IP-M Context Request message from the SGSN that the MS wants to join an IP-M group defined in this context activation message. The context activation message is received by the receiver Rx 11 of the GGSN and supplied to the control unit 10. Based thereon, the control unit 10 creates a list for every IP-M group, which maps the IP-M group ID to all tunnel IDs of  
25 the MSSs belonging to the defined group. This list is stored in the context memory 12.

When the GGSN receives the IGMP traffic from a multicast bone (MBONE) of the PDN via the receiver Rx 11, the control  
35 unit 10 checks the subscriber-specific list stored in the

- 8 -

context memory 12 as to any MS having joined the respective IP-M group. If the subscriber-specific list indicates a potential subscriber having joined the respective IP-M group, the GGSN returns a Create IP-M Context Response 5 message to the SGSN to thereby establish a point to point connection. The SGSN inserts the NSAPI of the TID included in the Create IP-M Context Response message and the GGSN address in its PDP context and returns a Create IP-M Context Response message to the MS. The SGSN is now able to route IP-M PDU between the GGSN and the MS. Thus, the GGSN 10 may now deliver a multicast PDU received from the PDN as a IP-M PDU via the SGSN to the MS.

The information about the available IP-M groups can be 15 delivered to the MS with the IP-M context procedure. In the context activation message, the MS may only inform the GGSN that it is interested in IP-M messages. Thus, when the GGSN receives an information about IP-M groups from the PDN (Internet) it has a pipe to all interested MSSs where it can 20 transmit the corresponding group information. Based on this information, the MSSs are able to inform the GGSN as to which multicast messages they want to receive, by using the Create IP-M Context Request message.

25 It is to be pointed out that the method and network element for forwarding the multicast message, as described in the preferred embodiment, can be applied in any packet radio network using a context activation for establishing point to point connections. Moreover, any kind of subscriber- 30 specific information defining a relationship between multicast groups and joint subscribers may be stored in a respective arbitrator network element of the packet radio network. The above description of the preferred embodiment and the accompanying drawings are only intended to 35 illustrate the present invention. The preferred embodiment

- 9 -

of the invention may thus vary in the scope of the attached claims.

In summary, the present invention relates to a method and  
5 network element for forwarding a multicast message received  
from an external packet data network to subscribers of a  
packet radio network, wherein a subscriber-specific  
information defining multicast messages to be received by  
the subscribers is stored in a network element of the  
10 packet radio network. Based on this subscriber-specific  
information, a point to point connection is established  
between the multicast content provider of the multicast  
message and a subscriber having joined the corresponding  
multicast group. The subscriber may request a list of  
15 available multicast groups from the network element and may  
inform the network element of the multicast messages he  
wants to listen to, by using a point to point context  
activation. Thus, the network element which may be a  
gateway GPRS support node plays an arbitrator role for  
20 multicast messages, such that only minor changes of  
standard network elements are required.

10

**Claims**

1. A method for forwarding a multicast message received from an external packet data network (**PDN**) to subscribers (**MS**) of a packet radio network, comprising the steps of:
  - 15 a) storing a subscriber-specific information, which defines multicast messages to be received by said subscribers, in a network element (**GGSN**) of said packet radio network;
  - b) establishing a point to point connection between a multicast content provider and a subscriber, when said
  - 20 subscriber-specific information indicates that said received multicast message is to be received by said subscriber; and
  - c) transmitting the multicast message from said multicast content provider to said subscriber via said established
  - 25 point to point connection.
2. A method according to claim 1, wherein a request for available groups for multicast messages is transmitted from a subscriber to said network element, and wherein an
- 30 information defining the desired groups which the subscriber wishes to join is returned from said subscriber to said network element.
3. A method according to claim 1 or 2, wherein said
- 35 subscriber-specific information is a list which maps group

- 11 -

identities of multicast groups to connection identifications of subscribers belonging to said multicast groups.

- 5 4. A method according to claim 3, wherein said group identity is an IP-M group ID and said connection identification is a GPRS tunnel ID.
- 10 5. A network element for forwarding a multicast message received from an external packet data network (**PDN**) to a subscriber (**MS**) of a packet radio network, comprising:
  - a) receiving means (**11**) for receiving said multicast message from said external packet data network (**PDN**);
  - b) storing means (**12**) for storing a subscriber-specific information which defines multicast messages to be received by said subscriber;
  - c) control means (**10**) for establishing a point to point connection between a multicast content provider of said received multicast message and said subscriber (**MS**), when said subscriber-specific information indicates that said received multicast message is to be received by said subscriber (**MS**); and
  - d) transmitting means (**13**) for transmitting said received multicast message to said subscriber (**MS**) via said established point to point connection.
- 15 6. A network element according to claim 5, wherein said control means (**10**) is arranged to generate said subscriber-specific information on the basis of a received subscriber request defining desired groups to be joined by the respective subscriber.
- 20 7. A network element according to claim 6, wherein said subscriber request is transmitted with an IP-M context request.
- 25

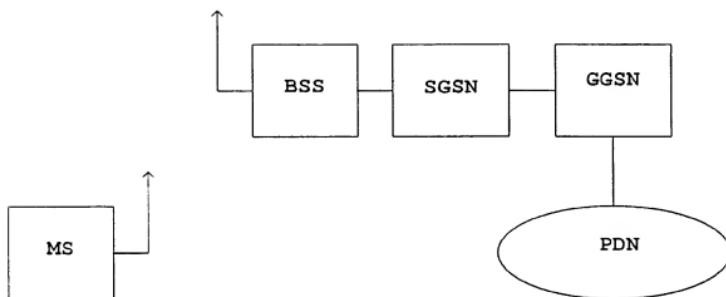
- 12 -

8. A network element according to any one of claims 5 to 7,  
wherein said transmitting means (13) is arranged to  
transmit an information defining available multicast groups  
5 to subscribers which have indicated their interest in  
multicast messages.

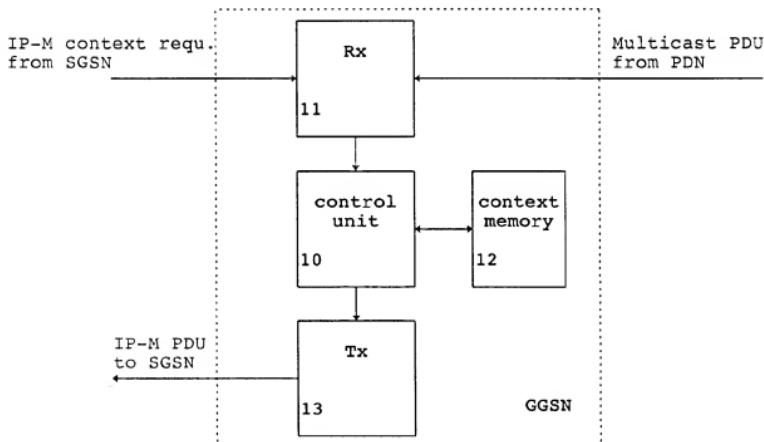
9. A network element according to claim 8, wherein said  
multicast group information is transmitted with an IP-M  
10 context procedure.

10. A network element according to any one of claims 5 to  
9, wherein said network element is a gateway GPRS support  
node (GGSN) and said subscriber-specific information is a  
15 list which maps IP-M groups to tunnel identifications of  
subscribers belonging to said IP-M groups.

11. A network element according to claim 10, wherein said  
received multicast message is included in an IGMP traffic  
20 of an IPM network to which said gateway GPRS support node  
(GGSN) is connected



**Fig. 1**



**Fig. 2**

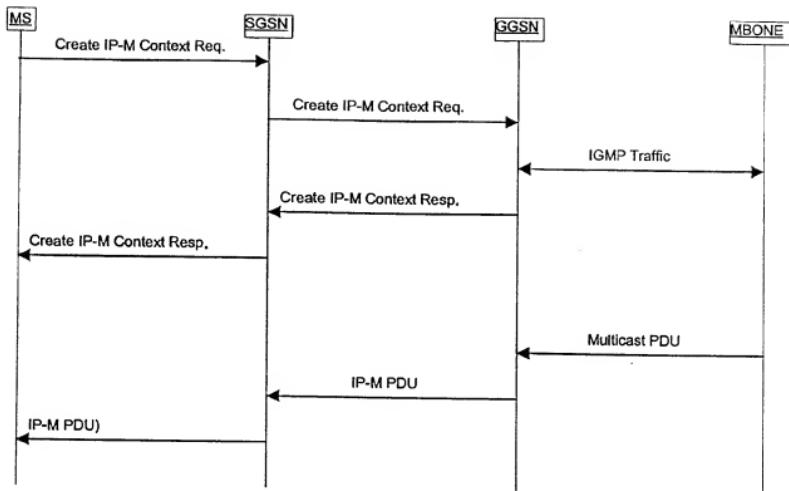


Fig. 3

## INTERNATIONAL SEARCH REPORT

International Application No  
I.U.T/EP 99/01969

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 H04L12/18 H04L12/56 H04L29/06

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 H04L H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	XYLOMENOS G ET AL: "IP MULTICAST FOR MOBILE HOSTS" IEEE COMMUNICATIONS MAGAZINE, US, IEEE SERVICE CENTER, PISCATAWAY, N.J., vol. 35, no. 1, page 54-58 XP000683443 ISSN: 0163-6804 page 54, line 1-4 page 54, left-hand column, line 23 -right-hand column, line 13 page 55, left-hand column, line 25 -right-hand column, line 15 page 55, right-hand column, line 50 - line 58 page 56, left-hand column, line 38 - line 60 ---- -/-/	1,3-7
A		2,8,10

Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

## \* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "U" document which may throw doubt on priority (claim(s)) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but sufficient to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"V" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual compilation of the international search	Date of mailing of the international search report
10 November 1999	23/11/1999
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl. Fax. (+31-70) 340-2016	Authorized officer  PALENCIA GUTIER., C

## INTERNATIONAL SEARCH REPORT

Int'l Application No  
I.U.T/EP 99/01969

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	AKESSON S: "GPRS, GENERAL PACKET RADIO SERVICE" IEEE INTERNATIONAL CONFERENCE ON UNIVERSAL PERSONAL COMMUNICATIONS, US, NEW YORK, IEEE, vol. CONF. 4, page 640-643 XP000690030 ISBN: 0-7803-2955-4 page 641, right-hand column, line 1 - line 3 19 page 642, left-hand column, line 6 - line 11 -----	1,10